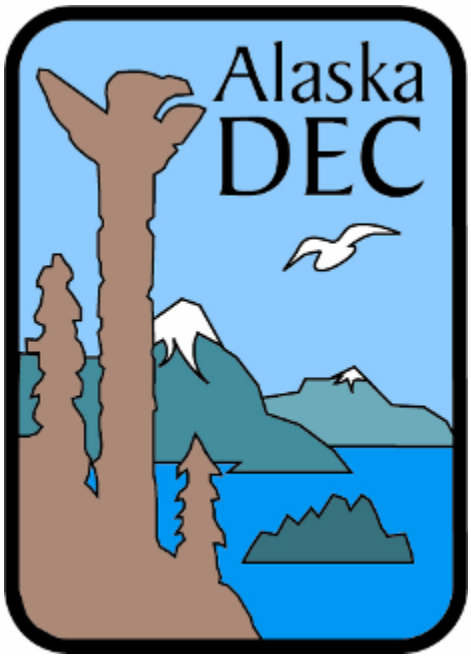
Alaska's 2011 Air Monitoring Network Plan

Chapter 1 – Monitoring Plan



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1.1.Introduction

In 1970 the Congress of the United States created the U.S. Environmental Protection Agency (EPA) and promulgated the Clean Air Act. Title I of the Clean Air Act (CAA) established National Ambient Air Quality Standards to protect public health. National Ambient Air Quality Standards (NAAQS) were developed for six *criteria pollutants*: particulate matter (PM), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), and lead (Pb). Particulate matter has two associated NAAQS; fine particulate matter particles less than 2.5 micrometers in diameter ($PM_{2.5}$) and coarse particulate matter particles less than 10 micrometers in diameter (PM_{10}). Thresholds limits established under the NAAQS to protect the health are known as primary standards. The primary health standards are to protect the most sensitive of the human population, including those people with existing respiratory or other chronic health conditions, children, and the elderly. Secondary standards established under the NAAQS are set to protect the public welfare and the environment.

Since promulgation of the ordinary Clean Air Act the EPA has continued to revise the NAAQS based on the assessment of national air quality trends and on current (and ongoing) health studies. Since 2008, the EPA has strengthened the NAAQS for lead, ozone, sulfur dioxide, and nitrogen dioxide. Table 1.1.1 presents the NAAQS standards with the most recent updates.

To protect public health and assess attainment with NAAQS limits, the State of Alaska Department of Environmental Conservation (DEC) established of air quality monitoring program. The State of Alaska represents a large geographical area with a small population. Anchorage and the Matanuska-Susitna (Mat-Su) Valley have the bulk of the 698,573 people in the state, about 54%. The remainder of the population is distributed among Juneau and Fairbanks with populations of about 30-40,000 and many scattered and isolated small villages most of which are off the road system and have populations ranging from 16 people to 10,000 people. The land area of the state is approximately 1.7 million square kilometers (km) or 680,000 square miles. In accordance with the National Monitoring Strategy, DEC plans air monitoring activities using the following criteria:

1. Monitor in larger communities to cover the largest possible population exposure;

2. Monitor in designated smaller towns and villages that are representative of multiple communities in a region; and

3. Monitor in response to air quality complaints.

In addition to the NAAQS for *criteria pollutants,* Title III of the Clean Air Act regulates a list 188 hazardous air pollutants, often referred to as *HAPs* or air toxics. These air pollutants have been shown to be carcinogenetic or exhibit high toxicity in humans and the environment. Air toxics are regulated through emission limits established for stationary sources, mobile sources, and other area sources. Special monitoring projects may be developed to evaluate source specific locations. Currently, DEC has no air toxics monitoring planned for 2010-2011

Table 1.1 – NAAQS for Criteria Pollutants

	Primary Standards		Secondary Standards	
Pollutant	**Level**	**Averaging Time**	**Level**	**Averaging Time**
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour[(1)]	None	
	35 ppm (40 mg/m^3)	1-hour[(1)]		
Lead	0.15 µg/m^3 [(2)]	Rolling 3-month Average	Same as Primary	
	1.5 µg/m^3	Quarterly Average	Same as Primary	
Nitrogen Dioxide	53 [(3)] ppb	Annual (Arithmetic Mean)	Same as Primary	
	100 ppb	1-hour[(4)]	None	
Particulate Matter (PM_{10})	150 µg/m^3	24-hour[(5)]	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual[(6)] (Arithmetic Mean)	Same as Primary	
	35 µg/m^3	24-hour[(7)]	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour[(8)]	Same as Primary	
	0.08 ppm (1997 std)	8-hour[(9)]	Same as Primary	
	0.12 ppm	1-hour[(10)]	Same as Primary	
Sulfur Oxides	0.03 ppm	Annual (Arithmetic Mean)	0.5 ppm	3-hour[(1)]
	0.14 ppm	24-hour[(1)]		

(1) Not to be exceeded more than once per year.

(2) Final rule signed October 15, 2008.

(3) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(4) To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed o0.100 ppm (effective January 22, 2010).

(5) Not to be exceeded more than once per year on average over 3 years.

(6) To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

(7) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).

(8) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor with an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

(9) (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 80hour average ozone concentrations measured at each monitor with an area over each year must not exceed 0.08 ppm.
(b) The 1997 standard – and the implementation rules for that standard—will remain in place for implementation purposed as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
(c) EPA is in the process of reconsidering these standards (set in March 2008).

(10) (a)EPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligation under that standard ("anti-backsliding".
(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1.

1.2.Monitoring Priorities

The Air Monitoring & Quality Assurance (AMQA) section of the DEC Air Quality Division has a small staff of professionals which coordinate with the Municipality of Anchorage, the Fairbanks North Star Borough, the City & Borough of Juneau and other smaller communities to support and operate the statewide monitoring system. To protect public health and the environment, the 2011 Alaska Monitoring Plan is focused on seven primary issues.

- Fine particulate matter ($PM_{2.5}$) monitoring
- Coarse particulate matter (PM_{10}) monitoring
- PM Difference ($PM_{10-2.5}$) monitoring
- Carbon monoxide (CO) monitoring
- Lead (Pb) monitoring
- Ozone (O_3) monitoring
- Wildland fire monitoring ($PM_{2.5}$)
- Rural communities and tribal village monitoring (primarily PM_{10})

1.2.1 Fine Particulate Matter-$PM_{2.5}$

The primary source of fine particulate matter is combustion. $PM_{2.5}$ is a major health issue for communities across the State of Alaska. More and more health studies show the higher rate of disease associated with particles penetrating deep into the lungs. For the people of Alaska, this problem is exacerbated by increased exposure to fine particulate during extended wintertime temperature inversions and wildland fires during the summer months. $PM_{2.5}$ monitoring is currently being conducted in all the major networks. Only the lead monitoring site in Noatak does not monitor for fine particulate.

Fairbanks has consistently experienced the highest $PM_{2.5}$ values measured in the state. During the winter months, Fairbanks' strong temperature inversions have contributed to trapping fine particle emissions in the lowest levels of the atmosphere. Based on winter $PM_{2.5}$ levels alone, Fairbanks had come close to exceeding the annual fine particulate standard (set at 15 $\mu g/m^3$) for the past seven years. Since the strengthening of the $PM_{2.5}$ standard in December 2006, Fairbanks routinely records 20-30 exceedances each winter over the new 24 hour standard of 35 $\mu g/m^3$. Based on these exceedances, in December 2008 the Fairbanks North Star Borough was designated non-attainment for the $PM_{2.5}$ NAAQS. Fairbanks North Star Borough, DEC, the University of Alaska, and a group of other air quality professionals are currently investigating the problem to develop an effective control strategy for bringing the community into attainment status.

Particulate pollution in Juneau was recognized in 1970s prompted by public complaints concerning road dust and woodstove emissions especially during wintertime inversions. The current monitoring site located in the Mendenhall Valley at the Floyd Dryden Middle School was originally established January 1, 1980. Based on exceedance throughout the 1980s, Juneau was designated non-attainment for PM_{10} in November 1991. The State of Alaska, and the City and Borough of Juneau developed a control strategy with an aggressive road paving program and a program to ban wood burning during periods of predicted temperature inversions. Data collected

over the last decade indicate that the coarse particulate part of the problem was solved. In December 2008, the State of Alaska proposed to the EPA to place Juneau under a Limited Maintenance Plan for PM_{10}. Although never designated as non-attainment for $PM_{2.5}$, increases in fuel costs for residential heating and revision of the NAAQS in 2006 lowering the 24-hour standard to 35 $\mu g/m^3$ is reason for concern. Monitoring values observed in the Mendenhall Valley during wintertime inversions are often close to exceeding the new limit. The City and Borough of Juneau are aggressively enforcing the burn ban and issuing citations with fines for noncompliant residents. Monitoring is ongoing with recent updates to instrumentation.

The Municipality of Anchorage began monitoring for $PM_{2.5}$ in November 1998 and is currently monitoring at three sites in the network. The Municipality continues to be in compliance with the $PM_{2.5}$ NAAQS.

In the 1990s and up to 2008 the population of the central Matanuska-Susitna Valley grew very rapidly. The communities of Wasilla and Palmer continue to grow and every year the DEC still receives several public complaints related to smoke from land clearing operations. To help local leader address air quality issues and to better protect public health, DEC installed a $PM_{2.5}$ continuous sampler in the downtown area of each community.

As part of a shift in the National Monitoring Strategy, Alaska began adding continuous $PM_{2.5}$ analyzers to Federal Reference Method (FRM) monitoring sites. The national long range plan was to convert all manual samplers to continuous analyzers to provide a more comprehensive monitoring database. The strategy required a collocation of continuous samplers with FRM monitors to determine if a bias existed in the collected data. This was considered an important step as agencies in the lower 48 states were noticing that the newer technology analyzers were producing significant data disparities. While analyzers have improved, and many have been designated as federal equivalent methods, running them collocated with an FRM sampler is still preferred by DEC to validate their performance as significant discrepancies exist and have been documented nationwide. The collocation is important, as good quality, continuous particulate data plays a critical role in calculating daily Air Quality Indices (AQI). The AQI is used to help develop air quality advisories and protect public health. Alaska continues to study the accuracy of these samplers. Continuous $PM_{2.5}$ analyzers are now in place at three monitoring sites in the Anchorage network, four sites in the Fairbanks North Star Borough, two sites in the Mat-Su Valley, and one site in Juneau

Thorough an intergovernmental agreement with the Municipality of Anchorage and the State of Washington real-time $PM_{2.5}$ data from the continuous monitors in Anchorage, Mat-Su, and Juneau are now available to the public through the Alaska Air Monitoring Network website at https://fortress.wa.gov/ecy/aaqm/Default.htm. DEC is working to connect the Fairbanks North Star Borough continuous monitoring data to the website before the end of 2010.

1.2.2 Coarse Particulates-PM10

The State of Alaska has been monitoring for dust in Anchorage, Juneau, the Mat-Su Valley, and Fairbanks for over twenty years. There are two locations in the State that were designated as non-attainment for PM_{10}, the Municipality of Anchorage and Juneau, both in 1991.

Eagle River, a community of about 30,000 located approximately 10 miles north of downtown Anchorage, is currently designated as a nonattainment area for airborne particulate, or PM_{10}. This designation is the result of air quality violations recorded between 1985 and 1987. A PM_{10} control plan was developed to address the PM_{10} problem in Eagle River. Because most of the PM_{10} in Eagle River was emitted from unpaved roads, this plan focused on paving or surfacing gravel roads in the area. This strategy has been successful. No violations have been measured since October 1987. A "Limited Maintenance Plan" has been proposed for Eagle River and is in the public review process.

The Anchorage bowl is currently considered an attainment area for PM_{10}. However, Anchorage has experienced exceedances of the NAAQS related to natural events such as volcanic eruptions and wind storms. Experience has shown that the effects of a volcanic eruption can linger for years following the event. Following the eruption of the Mt. Spurr volcano in August 1992, the NAAQS for PM_{10} was exceeded 18 times between 1993 and 1995. Intense wind storms in March 2001 and March 2003 created blowing dust conditions that contributed to a number of exceedances of the NAAQS. Because these exceedances were the largely the result of natural events, EPA has not considered them when evaluating Anchorage attainment status with respect to PM_{10}.

Although natural events have contributed to some exceedances, most PM_{10} in Anchorage is believed to have man-made origins. PM_{10} can be generated from vehicle traffic on unswept roads loaded with winter traction sand or from unpaved roads and parking lots. Anchorage sometimes nearly exceeds the NAAQS during spring break-up especially near heavily traveled roads where traffic stirs up a winter's worth of accumulated road sand.

The Municipality of Anchorage and State of Alaska have modified road maintenance practices in an effort to reduce PM_{10} emissions from roadways. In 1996 they began using a coarser, cleaner traction sand to reduce the amount of fines (silt particles less than 75 microns in diameter) being applied to the roadway network. In recent years the Municipality of Anchorage has used magnesium chloride brine, a chemical dust suppressant to reduce PM_{10} emissions during the spring break-up when PM_{10} concentrations tend to be highest.

As discussed above, Juneau was designated non-attainment for PM_{10}. However, data collected over the last 13 years has shown effective control of road dust. The State of Alaska and City and Borough of Juneau have submitted a PM_{10} Limited Maintenance Plan to Region 10 EPA. Monitoring is ongoing at the Floyd Dryden Middle School site.

The southern Matanuska-Susitna Valley, located 40 miles northeast of Anchorage, is transitioning from a rural-agricultural to an urban-suburban character. The cities of Wasilla and Palmer are the fastest growing communities in the state. Dust monitoring is currently performed at three sites; downtown Palmer, Wasilla, and in the Butte, a small community southeast of Palmer. Monitoring data typically show several exceedances of the PM_{10} NAAQS every year. Increased road paving has significantly reduced the road dust levels across the valley. However, all of the exceedances are related to exceptional events, high winds off the Matanuska River and Knik River drainages which entrain glacial silt raising dust levels into the unhealthy range.

These exceptional events occur during the spring, summer and into the fall until snow cover occurs.

1.2.3 Carbon Monoxide-CO

Strong wintertime temperature inversions and complex terrain resulted in non-attainment status for CO in Alaska's two largest population centers, Anchorage and Fairbanks. Both communities were designated as *Moderate Non-attainment* for CO in the late 1970s and re-designated as *Serious Non-attainment* in 1996. However, after implementation of air quality control strategies and improvement to automobile emission controls, both communities have collected years of CO data showing no violations of the NAAQS. Both communities requested re-designation to attainment and were placed in "limited maintenance status" in 2004.

The Anchorage CO monitoring network is currently comprised of four monitoring sites, one in east Anchorage, one in downtown Anchorage, one in west Anchorage near the airport, and one in Eagle River, a suburb of Anchorage ten miles to the northeast. The Municipality of Anchorage network has not recorded an exceedance of the CO NAAQS since December 1996.

The Fairbanks North Star Borough CO monitoring network originally consisted of three monitoring sites. The monitoring data has not shown an exceedance of the CO NAAQS for nearly a decade. Because of continued compliance with the standard and the need to refocus on $PM_{2.5}$ non-attainment, the Fairbanks monitoring program had requested EPA and was approved for a reduction in the number of CO monitoring sites. Fairbanks currently operates one CO monitoring site.

1.2.4 Lead Monitoring-Pb

To comply with the November 2008 revision of the Pb NAAQS, DEC established a source oriented monitoring site near the Red Dog Mine in the Northwest Arctic Borough. The Red Dog Mine extracts zinc and lead ore from an open-pit mine and concentrates the ore for export. The lead NAAQS requires source-oriented monitoring for all facilities that have potential annual emissions equal to or greater than one ton of lead. The Red Dog Mine is the only emission source in the State of Alaska that meets this criterion. The area around the mine is extremely rugged terrain with no road access. The monitoring location selected was the Native Village of Noatak; the closest population to the Red Dog Mine EPA sanctioned the change in the monitoring from source-oriented to population-oriented because of Alaska's rural character. The monitoring site was established in January 2010 and consists of collocated samplers which collect samples for total suspend particulate (TSP). The samples are collected and returned to Anchorage for laboratory analysis at the DEC EH lab.

1.2.5 Ozone Monitoring-O_3

The March 27, 2008 revision of the O_3 NAAQS requires the State of Alaska to establish an O_3 monitoring program by April 1, 2010. The regulation requires at least one SLAMS O_3 site in a core based statistical area (CBSA) with a population greater than 350,000. The Anchorage/Mat-Su Valley population forms the only combined MSA in the State of Alaska which meets the criteria. The Municipality of Anchorage monitoring program established two monitoring sites in

April 2010. The sites are initially designated as special purpose monitors until data analysis can be performed to determine the appropriate SLAMS site location. Another O_3 site will be located in Fairbanks with establishment of the NCore site. The US National Park Service operates a CASTNET O_3 monitoring site at the Denali National Park, which is under consideration to provide background regional O_3 concentration data

1.2.6 Rural Community and Tribal Village Monitoring

The State provides support to Alaska's rural communities make baseline assessments of local air quality. Because a majority of the citizens in these communities are Alaskan Native, much of the monitoring is supported by EPA's Indian Environmental General Assistance Program (IGAP) or EPA's Tribal Air Grant process. The IGAP program provides limited funding for equipment and training for monitoring for baseline assessments but not for regulatory purposes.

The State believes the high dust levels reported in the rural communities of Buckland, St Mary's, Kotzebue, Bethel, Kiana, Kivalina and others represent the conditions that would be found in other rural communities across the state if they performed PM_{10} monitoring. This conclusion has been supported by numerous tribal studies done in the past few years. Most of the tribal monitoring has been done in the Northwest Arctic Borough but some villages elsewhere in rural Alaska support the same conclusion.

This year, the DEC, along with the State of Alaska DOT and the University of Alaska – Fairbanks are working together to identify and test potential dust control strategies for use in rural Alaska. The DEC is involved in the DOT project in that it has the University of Alaska – Fairbanks assessing the efficacy of the palliatives applied for dust control using a monitor called the "*Dustm*." Eight villages that have shown dust problems in the past (values exceeding the PM_{10} NAAQS although it was just baseline monitoring), have been chosen for a DOT demonstration project. Two of those villages, Galena and Fort Yukon have been selected for air monitoring to assess the efficacy of the palliatives used in the dust control provided by the DOT using the *Dustm* (UAF) and TEOM (DEC). In addition to the two villages, North Pole is going to be used as a test site to correlate the *Dustm* (UAF) to the TEOM and/or EBAM (DEC). The State might use the FRM Andersen high volume monitors in Ambler and Buckland to assess the use of palliatives in those two villages as well. Ambler is a special case in that the village is located in a region with high asbestos which naturally occur in the rocks. Therefore the PM_{10} concentrations (fugitive road dust) could be potentially much more dangerous to the health of the residents than elsewhere. The State is not planning to seek a PM_{10} non-attainment designation for rural communities at this time, but may in the future if the easier solutions for dust control are not found to be effective.

Portions of rural Alaska may also have a $PM_{2.5}$ wood smoke problem. Strong winter inversions in interior Alaska coupled with weak economies, higher home heating bills, and easy access to wood have seen Alaskan's woodstove use on the rise. The impact on these small communities is unknown at this time, but cannot be overlooked in terms of public health safety. However, at this time, the State is not planning any future monitoring to assess the $PM_{2.5}$ concentrations in rural Alaska.

1.2.7 Wildland Fire Monitoring

During the summer months when wildland fires spread thick, grey smoke over interior Alaska, Fairbanks and many other communities are often inundated with very high fine particulate levels. During the summers of 2004 and 2005, the community suffered through days with particulate levels that were more than 10 times the old standard of 65 $\mu g/m^3$. At times, smoke from these fires covered most of interior Alaska from the Bering Sea eastward to the Canadian border. The addition of two monitoring staff in 2005 from State general fund dollars has assisted in the protection of the public from smoke impacts. The meteorologist position has direct access to all National Weather Service data and has worked closely with state and federal fire suppression staff to develop smoke forecasts and air quality advisories to better protect public health. This position has also been involved with developing a real-time smoke monitoring capability for taking direct measurements of smoke downwind of the fires. In summer 2010, DEC is planning to place two continuous fine particulate monitors at Fort Yukon and Galena, both in Alaska's interior, which are anticipated to be impacted by summer fire events.

1.2.8 Other Monitoring Issues

The State has a number of other monitoring projects on which the AMQA staff plan to bring to completion.

1.2.8.1 Air Toxics

The Kotzebue Air Toxics Monitoring Study was conducted in Northwest Alaska between December 2004 and April 2006. After many logistical and staff related delays, the field monitoring was successfully completed. DEC teamed up with Washington State University (WSU) for analytical services and to help identify compounds of concern. DEC has completed the review and analysis of the analytical data, and is in the process of finalizing the project write-up. Loss of staff involved with this project and re-assignment of monitoring priorities has delayed the completion of the final report, which is expected to be out by the end of 2010.

1.2.8.2 Rural Diesel Health Study

As part of the low sulfur diesel initiative, DEC evaluated the impact of diesel emissions on the residents of a small rural Alaskan community. After an extensive search, the Native Village of St Mary's was selected as the location for the investigation. The study monitored ambient air down-stream from the village power plant for NO_X, SO_2, and diesel particulates ($PM_{2.5}$ filter analysis using a TEOM with an FDMS module, diesel particulate assessment using a diesel particulate matter (DPM) cassette, and diesel particle analysis using an aethalometer). Field monitoring started in January 2006 and ran through April 2006. The collected data was analyzed and a final draft report has been developed and is undergoing peer review. An unexpected loss of staff and reassignment of monitoring priorities has delayed the final version of this report, and a new target release date is set for late 2010.

1.2.8.3 CIRIAMS Network

The Municipality of Anchorage received additional air quality funding through the congressional delegation in 2005 and has expanded the Upper Cook Inlet air monitoring network to include the Mat-Su Valley and upper Kenai Peninsula as part of the Cook Inlet Region Integrated Air Monitoring System (CIRIAMS).

The CIRIAMS monitoring network is intended to provide real-time data from continuous particulate monitors to the public and help the Department issue more timely air quality advisories. Continuous particulate monitor are already located at two sites in Anchorage at the Department of Health and Human Service (DHHS) site and the Garden site. The network also includes the continuous particulate monitors located at the Palmer and Wasilla sites. DEC is planning another site in the Kenai/Soldotna area. The project was delayed but is anticipated to be rescheduled for installation later in 2010. Similar to the other CIRIAMS sites in Anchorage and the Mat-Su Valley, Kenai/Soldotna site monitoring shelter will house two continuous particulate monitors to provide data for PM_{10}, $PM_{2.5}$, and $PM_{10-2.5}$. The monitors will be integrated with the data acquisition system to allow for real time data access on the Alaska Air Monitoring website.

1.3. Network Modifications

DEC reviews and modifies the State's air monitoring network annually based on the needs of the State, available funding and EPA guidance. The 2010/11 monitoring network will include expansion of the Fairbanks North Star Borough network. Budget cuts and staff shortages have had a significant impact on the DEC's ability to conduct planned monitoring activities. Except for the above described expansion to the Fairbanks monitoring network, the summer forest fire smoke monitoring and road dust related sampling activity in support of the Alaska Department of Transportation &PF, no significant changes to the network are expected. Detailed descriptions of the network monitoring sites follow in Chapters 2 – 6, and a summary table of AQS site identification numbers and site specific input parameters in Appendix C.